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Decisional Draft

Engineering Evaluation/ Cost Analysis for Disposal of Structural Concrete and Soil from the 183-H Solar Evaporation Basin and 100-D Ponds Closure

Environmental Excellence
HANFORD

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Bechtel Hanford, Inc.
Richland, Washington

For DOE/RL Review

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1.0 INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) addresses alternatives for disposal of materials from two Resource Conservation and Recovery Act (RCRA) units: 1) structural concrete and soils generated from the closure of the 183-H Solar Evaporation Basins (183-H), and 2) sediments excavated from the 100-D Ponds. The EE/CA was prepared pursuant to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This EE/CA is intended to aid the U. S. Department of Energy, Richland Operations Office (RL) in selecting a preferred disposal alternative for these wastes.

1.1 REGULATORY BACKGROUND

A brief description of the regulatory status of each unit is presented in the following sections.

1.1.1 183-H Solar Evaporation Basins

The 183-H are a series of four basins that were used from 1974 to 1985 for the treatment of liquid chemical wastes resulting from the 300 Area fuel fabrication facilities. The 183-H is a final status treatment unit under RCRA, currently undergoing closure in accordance with Washington Administrative Code (WAC) 173-303. It is also within the geographical area encompassed by the 100-HR-1 Operable Unit (OU), an area designated for remedial investigation under CERCLA. Groundwater contamination resulting from basin leakage will be remediated through actions associated with the 100-HR-3 groundwater OU. A RCRA closure plan has been submitted to the Washington State Department of Ecology (Ecology) and is included in the Hanford Facility RCRA Permit (DOE-RL, 1991). The Hanford Facility RCRA Permit requires that final closure be completed within 18 months of the Permit's effective date, September 28, 1994. A 60 day extension to this date was granted by Ecology in March of 1996. The RCRA closure plan contains information regarding remediation activities at 183-H. It does not identify a disposal site for removed structural concrete or soils.

183-H closure is proposed to meet the requirements for modified closure in accordance with the Hanford Facility RCRA Permit condition II.K.3. In order to meet these requirements, structures and soils must be removed where contaminated above action levels established under the Model Toxics Control Act (MTCA) Method C pursuant to WAC 173-340. These action levels have been previously agreed to by RL and Ecology.

1.1.2 100-D Ponds

The 100-D Ponds consist of two ponds, a percolation pond to the north and a settling pond to the south. These ponds received effluent from the 100-D Area industrial sewer system. The 100-D Ponds is an interim status RCRA treatment, storage, and disposal unit (TSD) unlined surface impoundment (disposal ponds), located in the 100-DR-1 OU, an area designated for remedial investigation under CERCLA. A RCRA closure plan has been submitted to Ecology and is scheduled to be revised and included in the Hanford Facility RCRA Permit in 1998 (DOE-RL, 1992). Voluntary remediation is scheduled to be performed prior to revision of the closure plan; details on the remediation can be found in the *Work Plan for the Excavation of Contaminated Materials from 100-D Ponds* (BHI, 1996a). The work plan presents several options for disposal of 100-D Ponds sediments, which are also identified and discussed in this document.

The goal for 100-D Ponds is to meet clean closure requirements, in accordance with the Hanford Facility RCRA Permit condition II.K.1 and II.K.2. Sediments which contain levels of contaminants above those established under the MTCA Method B pursuant to WAC 173-340 will be removed from the ponds. A list of contaminants and their cleanup levels have been identified and agreed to by RL and Ecology (BHI, 1996b).

2.0 SITE CHARACTERIZATION

2.1 SITE DESCRIPTION AND BACKGROUND

The following information is presented to gain historical perspective on 183-H and 100-D Ponds closure actions. The purpose of this EE/CA is to determine the appropriate disposal alternative for structural concrete and soils generated from these closure actions. Decisions regarding the closure actions that have occurred and will occur in the future have been and will continue to be made under the authority of Ecology. These decisions are outside the scope of this EE/CA.

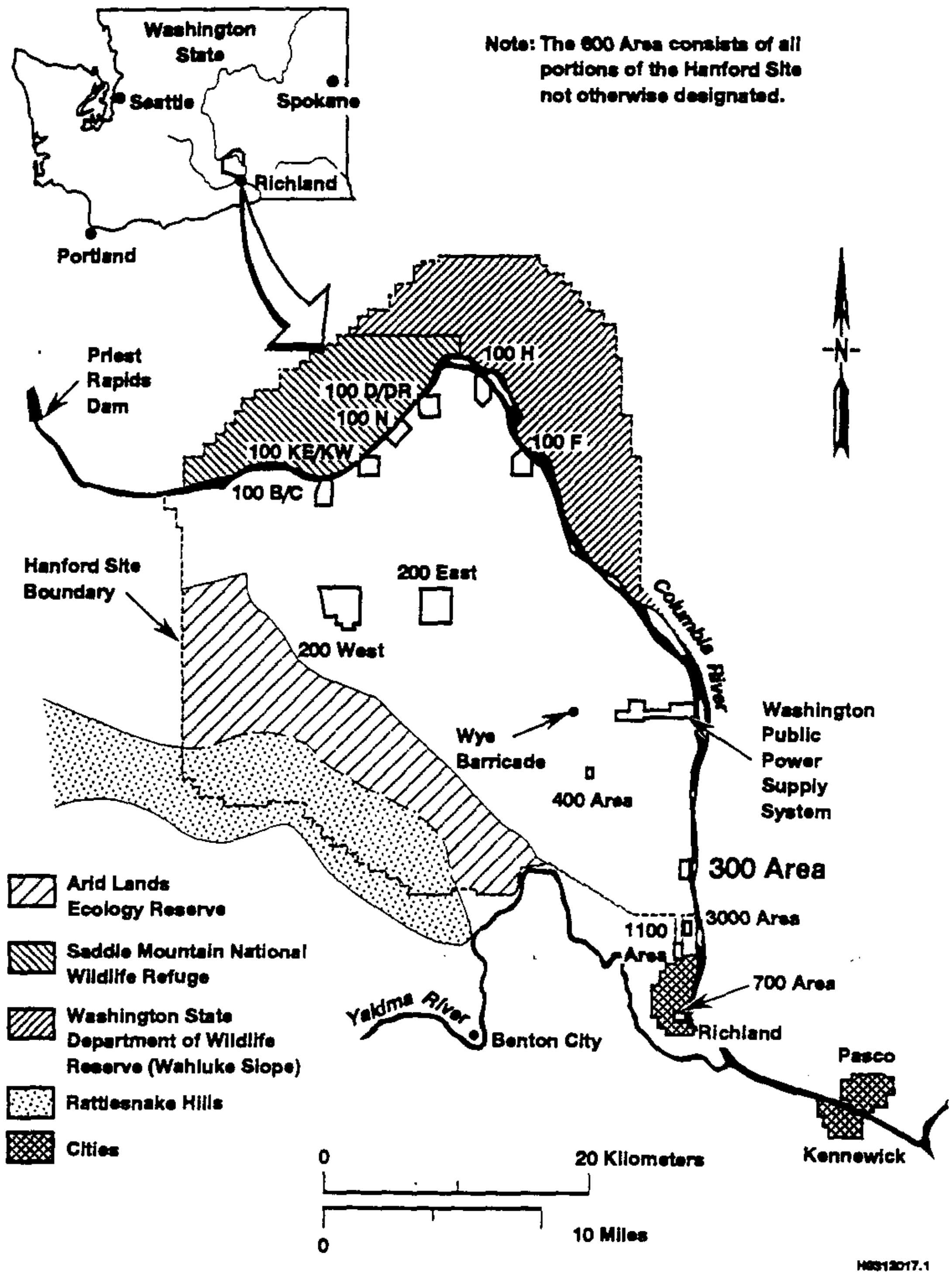
2.1.1 183-H

The 183-H is part of the 100-H Area, located in the northern part of the Hanford Site along the Columbia River (Figure 1). The 100-H Area contained a nuclear-defense, production-reactor facility that operated from October 1949 to April 1965. The 183-H structure consists of four basins (aboveground concrete structures) which remain from operation of the 183-H Water Treatment Facility. The 183-H Water Treatment Facility provided water treatment and reservoir capacity for the reactor process water system. This filter plant operated concurrently with the start-up and shutdown of the 105-H Reactor.

The 183-H Water Treatment Facility consisted of a head house and chemical building, a filter building and clean water storage vaults (clear wells), a pump room, and sixteen basins. Each of these basins is made up of a shallow flocculation basin and a deeper sedimentation basin. Most of the facility was demolished in 1974. Demolition rubble was used as backfill in the nearby clear wells. Four basins were left intact and designated for use as a solar evaporation facility for chemical waste. The adjacent clear wells were also left intact for future use as a clean-debris disposal site.

Each of the four intact basins consists of a flocculation and a sedimentation reservoir. The width of the concrete basin walls is uniformly 15 cm (6 in.) and the basin floor is 13 cm (5 in.) in minimum thickness.

Figure 1. Hanford Site



Beginning in 1973, Basin 1 (basins are numbered 1 through 4 from east to west) was used for storage of caustic solutions resulting from the addition of an excess of sodium hydroxide to spent acid-etch solutions from N Reactor fuel fabrication facilities in the 300 Area of the Hanford Site, as well as for miscellaneous used and unused chemicals. A total of 9,462 kL (2.5 million gal) of caustic solution was discharged to the basins during the period of waste operations. The solution consisted primarily of sodium nitrate with lesser amounts of miscellaneous chemicals, including copper, sulfate, fluoride, uranium and technetium-99. The waste stream included small amounts of listed waste constituents, as defined by WAC 173-303-080, including formic acid (U123), vanadium pentoxide (P120), and cyanide salts (P029, P030, P098, P106). The solution was designated mixed waste.

Waste deposited in the basins underwent volume reduction through evaporation. The use of Basin 1 to treat spent fuel fabrication waste continued until the detection of nitrate and chromium when Well 199-H4-3 was monitored, and there was an indication that possible spill or leak material was reaching the groundwater. Use of Basin 1 was discontinued in 1978. Spray-on polyurethane liners were then installed in Basins 2 and 3, and the liquid waste from Basin 1 was transferred into Basin 3 in 1978. (Basin 1 solids and sludges were removed in 1985.) Basin 2 first managed waste in 1979. Shortly before its use in 1982, Basin 4 was lined with a spray-on white butyl/Hypalon™[1] liner after it was observed that the spray-on polyurethane coating in Basins 2 and 3 showed degradation from sunlight. The last shipment of waste to the basins occurred in November 1985. The liquid content of Basin 2 was transferred to Basins 3 and 4; Basin 2 solids and sludges were removed in 1986. Also in 1986 a high-density polyethylene liner was installed in Basin 2. The liner was field seamed and 100% vacuum tested to ensure a leak-tight installation, then the accessible liquid waste from Basins 3 and 4 was transferred into Basin 2.

2.1.2 100-D Ponds

The 100-D Ponds is an unlined surface impoundment (disposal ponds), located north of the perimeter fence of the 100-D Area. The TSD consists of two ponds: a percolation pond to the north and a settling pond to the south. The two ponds were excavated into previously existing coal ash (126-D-1 Ash Disposal Basin, a CERCLA unit). The source of this coal ash was the 184-D Powerhouse, which was in operation from 1950 to 1966. The ash was deposited into an excavated basin as a slurry that had been discharged through the 100-D Area industrial sewer system.

This TSD was constructed as one pond in 1977 to receive liquid effluent from the 100-D industrial sewer system. To eliminate a bottom sealing problem which was inhibiting percolation, the original pond was divided into two ponds in 1979. The ponds are separated by an earthen dike and connected by metal pipes so that water from the settling pond could be decanted into the percolation pond.

[1]Hypalon is a trademark of E.I. Du Pont de Nemours and Company.

The effluent discharged into the ponds originated mainly from the 183-D Water Treatment Facility. This effluent consisted of alum-precipitated sand filter backflush and wash water from the settling basins. The other principle source of effluent came from the 189-D Mechanical Development Laboratory, which contributed corrosive demineralizer regenerative solutions to the waste stream (waste code number D002) and potentially discharged miscellaneous undocumented chemicals through the process sewer system. The 100-D Ponds have not received dangerous waste since 1986, and discharges were completely suspended in June 1994.

2.2 PREVIOUS REMOVAL ACTIONS AT 183-H

Before the implementation of initial RCRA closure activities in 1986, Basins 2, 3, and 4 held waste consisting of three distinct layers: a basal crystalline layer, a sludge layer, and a liquid layer on the top. Using Sorbond LPC-II™[2] colloidal cement, the liquid waste was solidified inside lined U.S. Department of Transportation (DOT)-approved 17-H, 55-gallon drums. The sludge and crystalline layers were removed from the basins by manually shovelling and/or scooping the material into lined DOT-approved 17-H, 55-gallon drums.

Basins 1 and 4 were subsequently cleaned by wet sandblasting. Waste generated during sandblasting was packaged as were the solids and sludges described previously. The drums containing the liquids, solids, sludges, and sandblast waste were sealed and taken to the Hanford Site Central Waste Complex Retrievable Waste Storage Unit (CWC). By the end of 1990, all bulk (non-containerized) waste had been removed from the 183-H.

Berm soils (153 m^3 or 200 yd^3) along the east and west sides of the basins were sampled, removed, placed on plastic just south of the 183-H, and sprayed with Arrospray 70™[3] (a clear soil binder) to minimize wind dispersal and erosion. These soils were sampled in 1996 and determined to be clean from a nonradiological (dangerous constituents are below MTCA B cleanup levels) and radiological standpoint and are to be released for use as clean fill material. These soils are not subject to this evaluation.

Structural concrete and soils have been determined to not contain listed waste (due to the granting of contained-in determinations for these wastes) and do not exhibit a dangerous waste characteristic, therefore they are not subject to WAC 173-303 requirements for disposal. The 183-H structural concrete was decontaminated in 1995 through a scabbling extraction technology to remove the top 6 mm of contaminated surface. The contaminated residual was characterized as low-level radioactive waste, containerized, and disposed to Low-Level Burial Grounds (LLBG). The residual is not subject to this evaluation. Approximately 3,366 m^3 (4,400 yd^3) of structural concrete was free-released for radioactivity and disposed of in the adjacent clearwell. This concrete is not subject to this evaluation. Approximately 1,683 m^3 (2,200 yd^3) of concrete

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[2]Sorbond LPC-II is a trademark of the American Colloid Company.

[3]Arrospray 70 is a trademark of the American Cyanamid Company.

is designated as low-level waste and is being stored adjacent to the unit. A disposal decision for this concrete is pending subject to this evaluation. Soils contaminated above action levels were removed from below and immediately surrounding the basins in February of 1996 and are currently stockpiled adjacent to the unit. A disposal decision for these soils is also pending subject to this evaluation.

2.3 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

2.3.1 183-H

Following removal of the process waste managed at the 183-H, concrete and soil sampling was performed in 1989 and 1991 to evaluate the possibility of residual contamination at the site. Laboratory chemical and radiological analyses of the 183-H concrete, shallow soils beneath and adjacent to the basins, and the deeper soils of the vadose zone beneath and surrounding the basins, were conducted using standard methods. Chemical analyses were conducted in accordance with *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods* (EPA, 1986) at offsite laboratories. Data, sampling and analytical methods, sample number and locations, and quality assurance/quality control (QA/QC) measures are reported in the *RCRA Closure Data Evaluation Report: 183-H Solar Evaporation Basins Soil and Concrete* (WHC, 1994).

As part of a Data Quality Objectives process carried out between RL and Ecology (August 1995), constituents of concern and their associated action levels were determined. Constituents of concern that were removed to levels below action levels in soils include arsenic, chromium, copper, fluoride, nickel, mercury, and nitrate. Surface soil contamination above action levels was largely contained in plumes attributable to fluoride and nitrate contamination. Nitrate and fluoride contamination extends down to an estimated 12.2 m (40 ft) depth to groundwater under Basins 1 and 2. Both soils and structures removed from 183-H that have not been decontaminated or free released will be defined as low-level radioactive waste.

2.3.2 100-D Ponds

Solid and colloidal materials suspended in the discharged effluent contributed to the 60 to 150 cm (2 to 5 ft) thick layer of sediment which currently occupies the bottom of the settling pond. This layer contains elevated concentrations of several heavy metals and polychlorinated biphenyl (PCB); however, characterization data indicate that the contamination does not continue into the ash underlying the pond.

2.4 ANALYTICAL DATA

2.4.1 183-H

Analytical data for contaminated structural concrete and for soils are incorporated by reference in the *RCRA Closure Data Evaluation Report: 183-H Solar Evaporation Basins Soil and Concrete* (WHC, 1994). Removed soils are contaminated with constituents of concern at levels below dangerous waste designation limits and above MTCA Method C action levels. Constituents of concern include arsenic, chromium, copper, fluoride, mercury, nickel, and nitrate. Removed structural concrete from 183-H contains little chemical contamination attributable to waste operations. The extraction technology utilized to clean the concrete was highly effective in the removal of both chemical and radiological constituents.

2.4.2 100-D Ponds

There have been two sampling and analysis efforts for characterization of 100-D Ponds. Phase I sampling was performed in August and September 1992 and was designed to provide information to develop a closure strategy for the ponds. Only surface samples were collected during Phase I sampling (WHC, 1992).

Phase II sampling was performed in January 1995. As part of that effort, test pits were dug to collect soil samples for analysis of volatile organic analytes (VOAs), semi-VOAs, PCBs, metals, anions, total organic halides (TOX), and radiological constituents. Split samples were also collected and analyzed by Ecology. This field activity is described in *Description of Work for 100-D Ponds Sampling, Phase II* (BHI, 1995a). The analytical results are reported in *Data Evaluation: 100-D Ponds* (BHI, 1995b). These results indicate that the sediments at the bottom of the settling pond were the only materials associated with the TSD that contained analyte concentrations above MTCA cleanup limits. Arsenic, lead, and Aroclor-1254 and Aroclor-1260 exceed MTCA B cleanup levels, although they do not designate the sediment as dangerous waste under WAC-173-303.

3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

3.1 183-H REMOVAL ACTION OBJECTIVES

Remediation of 183-H has resulted in the generation of 1,683 m^3 (2,200 yd^3) of structural concrete and 3,290 m^3 (4,300 yd^3) of soils. These materials are the subject of this evaluation and will require disposal at a landfill designed to manage low levels of radiologically and chemically contaminated debris and soils. Interim storage of the debris and soils is provided adjacent to the 183-H site. Structural concrete in storage at 183-H contains minimal chemical or radiological contamination and is not designated as dangerous waste. Soils removed from the unit also are stored in an area adjacent to 183-H.

3.2. 100-D PONDS REMOVAL ACTION OBJECTIVES

Approximately 1,030 m^3 (1,350 yd^3) of sediment will be removed from the 100-D Ponds to achieve cleanup goals. The sediment will be excavated from approximately the upper 0.6 to 1.5 m (2 to 5 ft) of the settling pond bottom, and disposed of in a landfill designed to manage low levels of radiologically and chemically contaminated soil. This assumption is based on the information in BHI 1995b and assumes an average sediment thickness of 1 m (3 ft). The sediment will be excavated down to the top of the powerhouse ash (as indicated by the distinctive black color). Verification sampling will be conducted at this point (DOE-RL, 1996). If the analytical laboratory results indicate contaminant concentrations above cleanup goals, excavation equipment will be remobilized (if necessary), and additional material will be excavated until cleanup goals are achieved.

4.0 IDENTIFICATION OF REMOVAL ACTION ALTERNATIVES

4.1 REMOVAL ACTION ALTERNATIVES FOR 183-H

Alternatives under consideration for the disposal of structures and soils from 183-H closure are as follows:

- No action
- LLBG disposal
- Environmental Remediation Disposal Facility (ERDF) disposal

The no action alternative for this alternative analysis would consist of long-term storage of the concrete and soils adjacent to the unit. Because wastes cannot continue to be stored at the unit and must be removed in order to comply with RCRA closure actions, the no action alternative is not a viable alternative.

4.2 REMOVAL ACTION ALTERNATIVES FOR 100-D PONDS

Alternatives under consideration for the disposal of sediments from 100-D Ponds closure are identical to those for 183-H. The alternatives for 100-D Ponds disposal are:

- No action
- LLBG disposal
- ERDF disposal

Attainment of closure for 100-D Ponds in accordance with WAC 173-303 necessitates removal of sediment from the settling pond, so the no action alternative would consist of long-term storage of the material. For long-term storage, the sediments would be placed on plastic and sprayed with a crusting agent to prevent dispersal by the wind. This storage would occur in the vicinity of 100-D Ponds.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides an analysis of remedial alternatives evaluated against the following criteria: (1) overall protection of human health and the environment; (2) compliance with federal and state regulations; (3) long-term effectiveness; (4) reduction of toxicity, mobility, or volume through treatment; (5) short-term effectiveness; (6) implementability; (7) cost, and; (8) state and community acceptance.

5.1 OVERALL PROTECTION

The overall protection of human health and the environment criterion determines whether each alternative provides adequate protection of human health and the environment. Protection includes reduction of risk to acceptable levels (either by reduction of concentrations or the elimination of potential routes for exposure) and minimization of exposure threats (introduced by actions during remediation.) This first criterion is a threshold requirement and the primary objective of the remedial program. The no action alternative (long-term storage adjacent to the unit) would not be considered as protective of human health and the environment as would a disposal alternative due to potential releases of contaminants from the stored wastes into the air and soil column. The ERDF provides for disposal in a unit that meets landfill requirements under RCRA. This unit is double-lined and includes leak detection and leachate collection systems. The LLBG are unlined trenches and would be considered the less protective alternative.

The LLBG are available for disposal immediately and therefore would not require interim storage onsite. Interim storage prior to disposal at ERDF may be necessary at 100-D Ponds, although it would be for a very short time. Soil and concrete removal at 183-H was completed in February 1996, and these materials are currently being stored adjacent to the unit. The no action alternative fails to protect human health and the environment. Storage and subsequent disposal of the wastes at ERDF would be most protective of human health and the environment.

5.2 COMPLIANCE WITH REGULATIONS

Applicable or relevant and appropriate requirements (ARARs) in federal and state law must be met or waived for CERCLA response actions. For 183-H and 100-D Ponds, the no action alternative would have the potential to create a new chemically contaminated area, given the levels of these constituents relative to MTCA groundwater protection standards. This scenario would not provide compliance with RCRA closure requirements contained in WAC 173-303.

Structural concrete and soils from 183-H and sediments from 100-D Ponds are identified as low-level wastes. Structural concrete and soils do not contain listed waste (due to the granting of contained-in determinations for these wastes) and do not exhibit a dangerous waste characteristic, therefore they are not subject to WAC 173-303 requirements for disposal. Sediments from 100-D Ponds do not contain listed waste and do not exhibit a dangerous waste characteristic. Substantive requirements associated with radiation standards within Part 10 CFR 835 and 10 CFR 61 are considered ARARs for disposal of these wastes. The two alternatives under analysis, ERDF and LLBG, would comply with these ARARs.

Clean Air Act evaluation of potential airborne emission of particulates, radionuclides, and constituents of concern must be addressed as ARARs for the ERDF alternatives due to the interim storage need. It is not anticipated that interim storage will generate significant amounts of air pollutants.

5.3 LONG-TERM EFFECTIVENESS

The long-term effectiveness and permanence criterion assesses whether the alternatives leave a risk after the conclusion of remedial activities. The no-action alternative would not provide long-term protection to human health and the environment. Given the more protective nature of the design of a RCRA landfill relative to an unlined trench, it is concluded that ERDF would provide for more long-term effectiveness than would the LLBG.

5.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

The reduction of toxicity, mobility, or volume through treatment criterion assesses whether the alternatives permanently and significantly reduce the hazard posed by the site by destroying contaminants, reducing the quantity of contaminants, or irreversibly reducing the mobility of the contaminants. The no-action alternative provides no reduction in toxicity, mobility, or volume. Contamination resulting from 183-H process waste in contact with structural concrete was treated through extraction under RCRA closure action authority. Levels of radiological and chemical constituents remaining in structural concrete and in soils is anticipated to be very low and therefore would not benefit from further treatment actions. Chemical and radiological levels in 100-D Ponds sediment are also very low and would not benefit from further treatment actions.

5.5 SHORT-TERM EFFECTIVENESS

The short-term effectiveness criterion assesses whether the alternative provides adequate protection to human health and the environment during the remedial action, and how long it will take for the action to achieve the established objectives. The no action alternative will not have any short-term impacts. The ERDF alternative may require very short-term interim storage at 100-D Ponds until the disposal unit becomes operational. Interim storage will require double handling of wastes (once to store and then again to dispose) using the ERDF option. Worker safety aspects of interim storage are considered acceptable for either ERDF or the LLBG option.

Standard construction activities such as container management and transport can be managed safely.

5.6 IMPLEMENTABILITY

The implementability criteria assesses whether the alternatives are technically and administratively feasible. The no action alternative is implementable. Both disposal site alternatives under consideration are similar in technical and administrative implementability relative to disposal aspects. The LLBG option would have no implementability criterion issues relative to interim storage. The ERDF may require very short-term interim storage requirements. These implementation actions were minor.

5.7 COST

The cost criterion evaluates whether the alternatives are cost effective. The no action alternative would involve no incremental increase in cost. The total estimated disposal costs for ERDF do not include additional costs which would be incurred for interim storage prior to acceptance. The 183-H cost estimates are based on disposal of 4,973 m^3 (6,500 yd^3) of structural concrete and soils; the 100-D Ponds cost estimates are based on disposal of 1,030 m^3 (1,350 yd^3) of sediment. The estimated costs are:

DISPOSAL UNIT	COST	ESTIMATED DISPOSAL COST, 183-H	ESTIMATED DISPOSAL COST, 100-D PONDS
LLBG	\$482 [1] per yd^3	\$3,134,430	\$650,997
ERDF	\$55 [2] per yd^3	\$357,500	\$74,250

[1] This excludes transportation costs. Transportation to LLBG would increase the total disposal cost by approximately \$65,000.
[2] This includes transportation costs.

5.8 STATE AND COMMUNITY ACCEPTANCE

The state acceptance criterion evaluates whether the technical and administrative concerns of the state have been addressed. The community acceptance criteria evaluates whether the alternatives address the concerns of the local community. The state and community have not had an opportunity to formally comment on disposal alternatives. This criterion will be evaluated following completion of the public comment period and will be factored into final disposal decision making.

6.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Based on overall effectiveness, long- and short-term effectiveness, implementability, and cost, the ERDF is determined to be the preferred disposal alternative for disposition of 183-H structural concrete and soils and 100-D Ponds sediments. The ERDF alternative will provide a significant cost savings to the cleanup actions while providing a higher degree of protectiveness and effectiveness than would be provided through implementation of the LLBG alternative.

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